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Taiwan

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Total population	22,934,997 (as of October 2007)[a]
GDP per capita	USD 16,768 (NTD to USD: 32.167) (2007)[b]
Computer household penetration	79.4 (2007)[c]
Fixed-line telephones per 100 inhabitants	60% (2007)[d]
Mobile phone subscribers per 100 inhabitants	112% (as of December 2007)[d]
Internet users per 100 inhabitants	64.4% (December 2007)[c]
Domain names registered under .tw	4.32 million (as of July 2006)[f]
Broadband household subscribers	68.7% (2007)[c]
Internet international bandwidth	186,443.174 Mbps (as of February 2008)[e]

(Sources: [a]Ministry of the Interior 2007; [b]Ministry of Economic Affairs 2007; [c]FIND 2008; [d]National Communications Commission 2007; [e]Taiwan Net-work Information Center 2008; [f]Internet Systems Consortium

OVERVIEW

The Government of Taiwan has launched three major national information and communication technology (ICT) programs since 2002 — e-Taiwan (2002), m-Taiwan (2005), and u-Taiwan (2007). ICT development in the country has been on track, except for a recent setback caused by political differences. In February 2006, a new government agency, the National Communications Commission, was established to regulate both the telecommunications and broadcasting sectors. However, since more NCC commissioners were nominated by opposition parties, the Democratic Progressive Party (DPP)-led Executive Yuan did not show much support for the National Communications Commission's plans and policies. The lack of communication between the Executive Yuan, which is the highest administrative organ of the state, and the National Communications Commission resulted in failure to implement some ICT policies, and the industry has complained about inconsistent policies among government agencies. However, the situation is expected to improve soon with the legislative and presidential elections held in January and March 2008, respectively. The opposition party Kuomintang (KMT) and its candidate for president Ma Ying-jeou, both won the elections.

Another recent development that is likely to have a beneficial impact on the continued advance of the ICT industry in Taiwan is the improvement in relations with China. In April 2008 Vice President Vincent Hsiao visited China and had a dialogue with Chinese President Hu Jintao. Moreover, President-elect Ma Ying-jeou has promised to remove the cap (usually 40 percent of a company's net value) on investment in China after his inauguration. Ma said this would help Taiwanese businesses compete with multinationals in China and encourage businesses to keep their roots in Taiwan (Mo 2008).

In sum, it is too early to say that the prospects for Taiwan's economy in the coming years will be good, but the new government has at least committed to make the ICT industry more competitive than ever before.

TECHNOLOGY INFRASTRUCTURE

Fibre-to-the-home high speed Internet is replacing the traditional copper wire network in Taiwan. Newly built apartment buildings are being wired with Chunghwa Telecom's (CHT's) fibre optic networks, resulting in upload/download speeds of 10 Mbits per second, 50 Mbits per second, and 100 Mbits per second. Most households now have ADSL or cable modem for faster data transfers or video-on-demand entertainment. FIND (2007) notes that 68.7 percent of households surveyed have broadband access.

Taiwan has been praised internationally as the 'Republic of Computers' for its low-cost computer and peripherals production. However, the government is benchmarking Taiwan's ICT performance against South Korea's world-class streamlined broadband Internet infrastructure. Thus, the local Internet broadband market is being promoted, with local Internet users being given a wide variety of broadband services, including Asymmetric Digital Subscriber Line (ADSL), cable modem, leased line, Public Wireless Local Area Network (PWLAN), third generation (3G) phone, and 3G Data Card. The result is that the number of broadband subscribers reached over 6.09 million in early 2008 (*Intelligent Times* 2008).

To remain competitive with the most technologically advanced countries in the Asia Pacific, Taiwan has been keen to adopt the most recent Internet developments. For example, Taiwan's academic networks (consisting of universities and research institutes) and first-tier Internet Service Providers (ISPs) have pioneered in upgrading to Internet Protocol version 6 (IPv6) as the solution to the exhaustion of Internet Protocol version 4 (IPv4) and as a way of ensuring next generation Internet services development (Taiwan Network Information Center n.d.).

Taiwanese citizens are generally well-connected island-wide and the urban cities are considered as test beds of streamlined new wireless technologies. The capital city Taipei is a wireless 'Cyber City' — one of the first such cities in the world — supported with the broadband Wireless Local Area Network (WLAN) infrastructure. With the support of the new government, Taipei will team up with Intel to upgrade to Worldwide Interoperability for Microwave Access (WiMAX) infrastructure.

The Taiwanese are extremely enthusiastic about mobile phones. Most young subscribers have more than one mobile phone number, resulting in over 25 million mobile phone numbers issued by early 2008 and 112 mobile phone subscribers for every 100 inhabitants in early 2008 (National Communications Commission).

In contrast, Taiwan's digital television (TV) broadcasting services are not well accepted by the local population. Although audiences can now have 15 digital terrestrial TV channels, most broadcast programs remain unattractive digitized versions of earlier TV videos, and the number of digital cable TV subscribers remains low. With the sluggish development of digital TV broadcasting, most Taiwanese are unimpressed by the government-supported projection of a new digital TV broadcasting era in Taiwan by 2010. On the plus side, broadcasters are maintaining multiculturalism with daily drama programs broadcast in local dialects and two government-funded TV channels for indigenous people and the Taiwanese Hakka-speaking group.

KEY INSTITUTIONS AND ORGANIZATIONS DEALING WITH ICT

The National Information and Communications Initiative Committee (NICI) is the foremost government body responsible for ICT policies. Established in April 2001, NICI combines three ICT-related task forces under the Executive Yuan and is responsible for accelerating the development of the IT industry, e-commerce and related businesses; improving the efficiency of government services; promoting Internet usage and related applications; and enhancing the competitiveness of the IT industry.

Two other government agencies are involved with the development of the ICT industry. The Council for Economic Planning and Development (CEPD) is a ministerial-level agency that is responsible for drafting plans for national economic development, evaluating development projects submitted to the Executive Yuan, coordinating economic policymaking activities, monitoring the implementation of development projects, and implementing the goals set out in Challenge 2008, the Six-Year National Development Plan. The Industrial Development Bureau (IDB) of the Ministry of Economic Affairs (MOEA) provides assistance to all industries and businesses, and has divisions dealing with industry policy, industry development, knowledge services and electronic information.

Unlike the NICI, CEPD, and IDB, the National Communications Commission plays a regulatory rather than a planning role. The National Communications Commission was established on 22 February 2006 as an independent regulator governing the telecommunications, media, and information sectors. Authority over telecommunications and broadcasting that was originally under the Ministry of Transportation and Communications (MOTC), Government Information Office (GIO), and Directorate General of Telecommunications (DGT) was transferred to the National Communications Commission. Its key functions include licencing, enforcement, spectrum assignment and management, technical standards, regulation of information and communication security, and consumer protection. As an independent regulator, the National Communications Commission is not a member of the Cabinet and it is not under the supervision of the Executive Yuan.

However, according to Article 3 of the Communications Basic Law, national communications resources planning and the provision of guidance and incentives for industry development are to be performed by subordinate organizations under the Executive Yuan. Therefore, the MOTC and GIO still play a role in providing guidance and incentives to the telecommunications and broadcasting industries.

Among non-profit ICT organizations, the Industrial Technology Research Institute (ITRI) is the largest in Taiwan. It was founded in 1973 by the MOEA to meet the technological requirements of Taiwan's industrial development through applied research and technical services. It serves as the technical centre for industry and makes recommendations regarding industrial policy to the government.

Another non-profit organization, the Institute for Information Industry (III), serves as a joint government-private sector think tank to promote the development of the ICT industry (Taiwan Yearbook 2007). It proposes ICT policies to the government and provides the private sector with market analysis, ICT training,

interoperability standards, services and technology transfer (Dahl and Lopez-Claros 2005). It assisted the Science and Technology Advisory Group (STAG) of the Executive Yuan to implement the e-Taiwan Program, and it plays an important role in promoting digital content.

ICT AND ICT-RELATED INDUSTRIES

There are four fixed-line networks in Taiwan. Chunghwa Telecom (CHT, www.cht.com.tw) is the incumbent carrier. In 2000, the government granted three new fixed-line licences to Taiwan Fixed Network, New Century Infocomm Tech Co. and Asia Pacific Broadband Telecom (APBT). CHT is also the largest carrier in terms of market share, accounting for 51.8 percent of revenues for international services, 80.7 percent for domestic long-distance services, and 97.4 percent for local telephone services as of December 2006. CHT became a private company in August 2005, although government still owns 35.41 percent of its shares. In 2007, its total revenues were USD 5.82 billion.

Because CHT controls the last mile, the other three new fixed-line networks cannot compete with it in the local phone market. Although the government has allocated NTD 30 billion (about USD 98.4 million) to build the second backbone for the new entrants, this has not been successful and the new entrants have suggested that CHT's last mile be made public property so that other fixed networks can utilize it without paying high fees as they are doing now (Liu 2008). Although the National Communications Commission has designated CHT's last mile as bottleneck facilities and it has asked CHT to reduce user fees for its competitors, the new entrants are still not satisfied with CHT's dominance in the market and are proposing that WiMAX technology be used for the last mile.

Broadband services rely on the last mile as well, which means that CHT's branch company, HiNet, dominates 84 percent of the broadband market (TWNIC 2008). Because the new fixed-line networks still have problems regarding access to the last mile, they prefer to promote broadband services to small and medium-sized businesses and buildings that have access to high-speed Internet.

The mobile phone industry is composed of six two generation (2G) operators belonging to three telecom groups — Chunghwa Telecom, Taiwan Cellular Corp., and Far Eastone Telecommunications Co. As of December 2007, their market shares were as follows: Chunghwa, 40.28 percent; Taiwan Cellular, 31.38 percent; and Far Eastone, 28.34 percent. Five mobile phone companies provide 3G services. The first 3G service started in July 2003, while the other four operators came two years later.

The big telephone companies are all striving to implement Fixed Mobile Convergence (FMC) or triple play strategies. After

its merger with Taiwan Fixed Network and given its ownership of Fu Yang Cable TV, Taiwan Mobile Network has the greatest advantage to implement FMC and in fact started to adopt a triple play (mobile phone, cable TV, and cable modem) strategy in March 2008. On the other hand, CHT, which has the advantage of owning the last mile, combines IPTV, ADSL and the local phone in its triple play strategy. Cable operators that do not own telephone companies have applied for local phone licences to provide triple play services.

KEY ICT POLICIES, THRUSTS, AND PROGRAMS

Taiwan is widely recognized as an East Asian development model for its aggressive efforts in strengthening locally developed advanced technologies through government leadership (Wang 2003). For example, the government-led e-Taiwan Program was launched in May 2002 with the vision of transforming Taiwan to an 'e-Society, e-Industry, e-Government, and e-Opportunity'. The e-Taiwan Program upgraded urban IT infrastructure and brought international attention, with Taipei being recognized in 2006 as the 'Intelligent Community of the Year' by the Intelligent Community Forum for demonstrating 'sustainable competitiveness' in its use of broadband technology for economic development (Liu and Wang 2007). The e-Taiwan program also made broadband networks, such as Direct Subscriber Line (DSL) and cable modem, available and affordable for remote and rural residents, and the number of broadband subscribers grew to over 4.6 million by the end of 2007 (FIND 2008).

Following the establishment of a robust island-wide broadband infrastructure, the government launched the m-Taiwan Program in 2005 and the u-Taiwan Program in 2007 with the aim of transforming Taiwan into a ubiquitous network society. The plan is to invest NTD 37 billion (about USD 1.21 billion) in the m-Taiwan and u-Taiwan initiatives from 2005 to 2009, and to develop the infrastructure for wireless Internet access for eight million subscribers and to provide broadband Internet coverage to 80 percent of the population in urban areas. Moreover, seamless wireless networks established under the m-Taiwan program are expected to help solve the last mile problem.

To build seamless wireless networks with advanced technologies such as WiMAX, the government recently collaborated with the private sector, in particular leading computer brand Acer and global companies like Intel and Nortel, and the National Communications Commission issued six licences for WiMAX technology in July 2007. The hope is that the pro-WiMAX policy will enable last mile wireless broadband access (see 'Opening up WBA Licences').

Opening up WBA Licences

Under the m-Taiwan initiative, the WiMAX industry is expected to take off in 2008. Before the government issued Wireless Broadband Access (WBA) licences, some critics thought opening up the WBA licences was premature (*DigiTimes* 2008). However, the government thought that if Taiwan started WiMAX development earlier, it would have a chance to participate in setting the technology specifications and standards, and it can position itself as an industry leader rather than a follower. Since the Executive Yuan was very supportive of WiMAX, the National Communications Commission finished its licencing scheme in 2006 and issued six regional WBA (with WiMAX as one of the standards) licences in July 2007. The hope is that Taiwan's early promotion of WiMAX will attract foreign investment and hasten the development of the WiMAX terminal device manufacturing and WiMAX application service industries.

Indeed, under the m-Taiwan Applications Promotion Project led by the MOEA, Taiwan is the world's largest demonstration area for WiMAX applications and services. The WiMAX Forum has established the first WiMAX testing and certification laboratories in Taiwan, and large multinational companies such as Intel, NEC and Nortel have entered into agreements with Taiwanese companies. In April 2008, Intel signed a memorandum of understanding (MOU) with the MOEA promising to invest half a billion US dollars from 2008 to 2013 in 'across-the-board procurement and investment in Taiwan, including WiMAX' (Emigh 2008). Taiwan ranks second in the world, after the USA, in total investments in WiMAX (*Intelligent Times* 2008).

(Sources: *DigiTimes* 2008; Emigh 2008; *Intelligent Times* 2008)

LEGAL AND REGULATORY ENVIRONMENT FOR ICT DEVELOPMENT

At present there are three electronic media laws (the Radio and Television Act, Cable Radio and Television Act, and Satellite Broadcasting Act) and one Telecommunications Act. However, with the convergence of telecommunication and broadcasting, many laws and regulations have become outdated.

Article 16 of the Fundamental Communications Act states that the government shall amend the relevant statutes within two years of the National Communications Commission's establishment. Thus, in 2007, there were discussions about whether the Telecommunications Law and laws related to electronic media should be amended individually or integrated into one law (*DigiTimes* 2007). The National Communications Commission decided to integrate the four laws and submitted the draft converged law to the Executive Yuan in December 2007. Prior to submitting the draft to the Executive Yuan, the National Communications Commission held several public hearings at which various communication scholars and experts, public interest groups, and representatives of the telecommunication and broadcasting sectors expressed their concerns about the draft. It was felt that more discussion and dialogue was needed. Thus, it came as no surprise that the Executive Yuan returned the draft of the integrated law to the National Communications Commission in April 2008. The National Communications Commission must now decide whether to revise the four laws individually or to submit a revised draft of the converged laws to the new administration.

In addition to the convergence issue, the universal service issue has also caught the National Communications Commission's attention (see 'Broadband Access to Every Village').

DIGITAL CONTENT INITIATIVES

Taiwan's digital content industry is expected to create new job opportunities and employ over 70,000 people. In addition, its production value is projected to reach NTD 600 billion (about USD 19.68 billion) by 2011. Given the industry's size and the magnitude of its contribution to the Taiwanese economy, the government is committed to fostering digital creativity and innovation through various promotional initiatives and regular funding programs. The Digital Content Promotion Office under MOEA oversees these initiatives and programs. Its mission is to promote mobile content/services, online games, 2D/3D animation, software and streaming video products. A recent initiative is a training project by the MOEA in collaboration with leading online entertainment market player Sony Computer Entertainment (MOEA 2008).

The Cultural and Creative Industries Promotion Office aims to upgrade the business turnover from USD 12.20 billion to USD 18.59 billion and to increase jobs in the cultural and creative industries from 186,000 in 2006 to 280,000 by 2008. The program will also attempt to increase the ratio of household cultural expenditures from 13.5 percent in 2006 to 15 percent in 2008.

In 2007 the National Digital Archives Program (NDAP) received a boost with the participation of nine public institutions,

among these the Council for Cultural Affairs, the Council of Indigenous Peoples, the Chinese Taipei Film Archive of the Government Information Office and the National Archives Administration. One of the primary goals of the NDAP at this stage is to upgrade the NDAP through state-of-the-art ICTs such as Web 2.0.

ONLINE SERVICES

Like other countries with rapidly expanding broadband Internet coverage, Taiwan's government and commercial service providers are investing heavily in online services. Total revenues from Taiwan's e-commerce market, including online sales and online purchasing, increased by 10 percent from NTD 185.5 billion (about USD 6.08 billion) in 2006 to NTD 193.5 billion (about USD 6.35 billion) in 2007 (Taiwan External Trade Development Council 2007). The entire e-commerce market is expected to reach NTD 254.7 billion (about USD 8.35 billion) in 2008.

With the expansion of the broadband subscriber base, Taiwan's online gaming market has grown by 13 percent since 2006 with sales reaching NTD 8.4 billion (about USD 275.5 million) in 2007 (Market Intelligence Center 2007). Some big online game developers, such as Chinesegamer Co., have also joined the m-commerce market with mobile games and other mobile value added services (VAS).

Emerging e-government services supported by broadband networks are contributing significantly to e-Democracy in Taiwan. When they log on to the e-government portal (http://gov.tw), Taiwanese citizens are able to access policies, project updates, research reports, and public opinion surveys. Most citizens now file their tax returns, pay their traffic fines and apply for documents online.

ICT-RELATED EDUCATION AND CAPACITY-BUILDING PROGRAMS

Taiwan takes pride in its high-speed and low-cost educational online networks at all levels. All elementary schools, junior and senior high schools and universities nationwide are connected via the Taiwan Academic Network (TANet). TANet has in fact grown to be one of Taiwan's three major ISPs. It supports the Academia Sinica,[1] as well as e-libraries and e-periodicals, email, server hosting, over 4,000 English domain names (edu.tw), IPv6, e-learning, academic e-document exchange, video-conferencing, and information security for schools.

To ensure the success of e-learning programs, the digital divide between students in urban and remote areas is being addressed by the Ministry of Education through 300 Digital Opportunity Centers (DOC, http://itaiwan.moe.gov.tw/) in 168 rural villages. The goal is to broaden social participation in ICT applications and to provide education for all by 2008. The DOCs have state-of-the-art computer equipment donated by large companies such as Acer and HP. At the DOCs, less privileged and aboriginal students and residents, including the elderly, can take computer literacy courses that introduce basic email usage, e-learning fundamentals and e-commerce essentials. Although the DOC project has not yet been shown to significantly reduce the

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Broadband Access to Every Village

Article 12 of the Fundamental Communications Act stipulates that the government shall take necessary measures to promote the right of access to communications and the provision of universal service. Accordingly, the National Communications Commission revised the universal service regulation in December 2006 and incorporated broadband access within the scope of universal service. After finding out that all 46 remote villages with no broadband can be wired with only NTD 96.5 million (about USD 3.165 million), the National Communications Commission prioritized the 'Broadband Access to Every Village' project and completed it in late December 2007. Under the project, CHT, the dominant carrier, provided broadband access to 43 remote villages, while Taiwan Fixed Network Corporation provided broadband access to three remote villages. The two telephone companies can recover their losses from the universal service fund to which all telecom carriers with more than NTD 200 million (about USD 6.56 million) in capital contribute.

This universal service policy has helped reduce the digital divide between urban and rural areas and increase digital opportunities to remote villages. Broadband access enables e-learning programs. It also promotes tourism and agriculture in remote areas. Indeed, Taiwan became the first country in the world to introduce broadband access to every village under the mechanism of the universal service fund.

(Source: Liu 2003, 2008)

divide between the information haves and the information have-nots, the program is helping to upgrade the ICT skills of local residents, with the e-training courses and free Internet services reportedly attracting some over-70-year-old residents. In fact, more elderly residents in remote areas are maintaining their own weblogs.

To help address the digital divide in Asia Pacific, Taiwan proposed the APEC Digital Opportunity Center (ADOC, http://www.apecdoc.org/). Launched in 2004, the ADOC aims to transform the digital divide into a digital opportunity, and to prepare APEC economies to use ICTs as a passport to the new economy.

OPEN SOURCE AND OPEN CONTENT INITIATIVES

With the support of Academia Sinica, Creative Commons licences have been translated into the local copyright context. In addition, the Open Source Software Foundry (OSSF, http://www.openfoundry.org/) based at Academia Sinica and funded by the government has been working on further advocacy of creative commons and open content projects and encouraging the use of free and open source software (FOSS). Specifically, the OSSF is building a database of FOSS experts in Taiwan, developing Web-based tools for FOSS licence agreements, and encouraging the development and use of more free and open source Chinese language software. It conducts analyses of FOSS licences and national policies worldwide, and provides training courses to users and helps project owners choose the appropriate FOSS licences.

A recent initiative was Taiwan's hosting of the 2008 Open Tech Summit introducing open source and free content to an international audience held on 24–29 April 2008.

ICT RESEARCH AND DEVELOPMENT

In keeping with its vision of achieving the status of an advanced knowledge-based economy by 2010, Taiwan launched the National Si-Soft Project in 2003. Its goal is to transform Taiwan's IC industry from being mainly contract manufacturing to being R&D and innovation-oriented. More specifically, the project intends to make Taiwan the one-stop shop for IC design, mix-and-match intellectual properties, manufacturing and testing. With a target research and development (R&D) investment of USD 116.21 million, the project is expected to develop, by 2010, IC-related product outputs (including automation software, silicon intellectual property, embedded software and system single chip) totalling USD 14.47 billion.

CONCLUSION

The e-Taiwan, m-Taiwan, and u-Taiwan initiatives provide a clear direction for the growth of the ICT industry in Taiwan. But determination to implement these policies and collaboration among the relevant government agencies are also crucial to maintain Taiwan's competitive edge in the global ICT industry. For example, the ICT industry could have performed better after the National Communications Commission was established in February 2006 had there been no tension between the DPP-led Executive Yuan and the National Communications Commission. Now that the opposition party has won the legislative and presidential elections, the Taiwanese people are pinning their hopes on the new administration to help Taiwan to further improve its economy and strengthen its competitiveness. The Executive Yuan, the Legislative Yuan, and the National Communications Commission are expected to work closely in implementing Taiwan's ICT policies and regulations.

The political climate between Taiwan and China is also important to Taiwan's ICT performance. Taiwan's ICT industry has built many firms in China where labour is cheap and land prices are low. These firms produce 70 percent of China's IT output (Lin 2005). Having regular direct flights between Taiwan and China would save the Taiwanese firms a lot of time and money, which would translate to even higher productivity.

Finally, although Taiwan's ICT technology is advanced, the country needs to do more to improve industry standards and technology innovation. This is especially true in the case of WiMAX technology specifications and standards given Taiwan's early adoption of WiMAX licences.

NOTE

1. Founded in 1928, Academia Sinica leads and pioneers scholarly research in the sciences and humanities. It is the most internationally renowned academic institution in Taiwan. Affiliated with the presidential office, Academia Sinica has continually enjoyed independence and autonomy and it has guided the Taiwanese research community in international collaboration and ground-breaking research.

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